MODIS Science Team Meeting Summary

November 16–18, 1999
Plenary Meeting
November 16–17, 1999

1.0 Introduction

The Moderate Resolution Imaging Spectroradiometer (MODIS) Science Team meeting was held on November 16–18, 1999 at the Sheraton Columbia Hotel in Columbia, MD. The focus of the meeting was Science Team Launch preparedness. Vince Salomonson, MODIS Science Team Leader, convened the meeting and reviewed the agenda (see Attachment 1). Items on the agenda included a budget overview and presentations on DAAC and MODAPS readiness, early images, Aqua status, and the Terra launch. Salomonson told the group that Terra is ready for launch, including the science systems, mission operations, and the NASA Public Affairs Office (PAO). We are ready for launch and can produce information for validation and calibration. Terra is scheduled to launch no earlier than December 16, 1999 and no later than December 17, 1999 from Vandenberg Air Force Base in Santa Barbara, CA. If it does not launch on one of these 2 days, then the launch would be scheduled for January 2000, with the next window on January 10 or 26, 2000.

Salomonson told the group that a coordinated release of first images from all five Terra instruments is planned for Launch+60 (L+60) to L+90 days. Yoram Kaufman commented that the Japanese plan to release very early engineering images and we might want to do the same.

1.1 EOS/MODIS Budget Status/Team Recompete

Michael King presented an overview of the EOS/MODIS Budget Status and Science Team Recompetition (see Attachment 2). A brief description of the EOS budget status is included in his editorial in a recent Earth Observer (see The Earth Observer, September/October 1999, Vol. 11, No. 5). NASA's strawman schedule through fiscal year 2010 includes phasing of some of the second series EOS-II missions. The reduction in the algorithm budget is a transfer in funds from one budget to another rather than a budget reduction for science teams and the calibration budget is fairly stable and sustainable. For MODIS, the Science Team is funded from the algorithm budget and the validation budget and the decrease in algorithm funds does not affect MODIS. The validation budget has gone up and the MODIS Science Team budget is healthy and stable. Current Science Team contracts run through December 14, 2001. During the last budget cycle, all the teams were asked to delineate their budgets per algorithm development and instrument operations support. These are both to continue through the length of the mission. Data analysis, calibration, and validation will be competed through NASA Research Announcements (NRA's). For the next budget cycle, beginning in fiscal year 2001, budgets should be delineated between four categories. These are algorithm development, instrument operations support, data analysis, and calibration and validation. Data analysis, Unique Project Number (UPN) 621, may be

competed in science teams around a science topic, such as aerosols, with scientists representing various instruments rather than science teams organized around an instrument.

King said that the new Reference Handbook (1999 edition) includes a substantial update from the 1995 version. It describes the science and contacts for 72 EOS Interdisciplinary Science Investigations. The new chart of missions is kept updated on the Web (see http://eospso.gsfc.nasa.gov/eos_homepage/missions.html).

Salomonson commented that the NPOESS Preparatory Project (NPP) mission is going well and that Bill Barnes and Bob Murphy are attending NPP meetings this week. He said that both the IEEE IGARSS 2000 meeting and the AGU 2000 Spring Meeting would include special MODIS sessions.

1.2 Level 1 Software Status

Francesco Bordi presented an overview of MODIS Level 1 (L1) software status (see Attachment 3). The L1 product suite, which includes five PGE's, is ready for launch except for minor fixes that are to be completed within the next few weeks. The launch version of Level 1A and Geolocation (PGE01) works fine and is running in GDAAC 5A Operations mode (Ops). Level 1B (PGE 02), version 2.2.0 (v2.2.0), the launch version, also is running in DAAC Ops. Delivery of a new version of PGE02, v2.3.0, is anticipated by December 15, 1999. Bordi reviewed a list of enhancements in version 2.3.0 over version 2.2.0 using a chart prepared by Bruce Guenther, "Improvements in v2.3.0," (see Attachment 3). Masuoka said that after MCST delivers v2.3.0 to the DAAC, the Science Software Integration and Test (SSI&T) process would take about 2 weeks.

Cloud Mask (PGE03), v2.1.0 is in DAAC Ops and the launch version, v2.4.3, is in testing at the GDAAC with promotion to 5A Ops expected by December 10. Rich Hucek briefly reviewed the change history of PGE03, from v2.1.0 to v2.4.3, and discussed the differences between these versions (see Attachment 4). Some of the changes include removal of dependence on a Look-Up Table (LUT), optional use of the L1B 250m product, and an updated ecosystem reader. There is a lot of change to inputs and some new science functionality. The University of Wisconsin would like to use the NSIDC NISE facemap in the newer version (v2.4.3). Applications of the global clear sky radiance maps include using the output of PGE55 in PGE03 and PGE06. The next version of PGE03, v2.4.4, does not exit on missing geolocation data, which was a problem in earlier versions.

The L1A Subsetter (PGE71) launch version is in the DAAC and expected to be promoted to 5A Ops by December 10. The L1B Subsetter (PGE02A) launch version was promoted to DAAC 5A Ops in August 1999.

1.3 Level 1 QA Plans

Bruce Guenther reported on MCST L1B Quality Assurance (QA) plans and reviewed a map of planned validation activities (see Attachment 5). These slides were drawn from his presentation on Validation and Operational QA of L1B at the May 1999 Science Team meeting. (For more details see: http://modarch.gsfc.nasa.gov/MODIS/SCITEAM/199905/attachments.html, Attachment 14, May 1999.) MCST has planned a range of validation activities, including operational, characterization, and vicarious activities.

The DAAC will provide the Operational L1B daily QA metrics in a status report on L1B that may be posted on the MCST Web site. QA includes questions on how the MODIS instrument acts differently on orbit than in thermal vacuum and how it behaves as compared to earlier in the mission (benchmark day). Some of these updates should take place at about L+75 days. The daily status can be thought of as a daily scorecard that shows how the instrument has performed in the past 24 hours compared to standard performance.

Guenther expects about three to four LUT or algorithm changes before the Calibration Workshop and he expects the first Validation Workshop within the first 60 to 90 days after launch. At about L+65 days we will begin to get feedback from science data. MCST plans to hold daily meetings and invites broad participation from Science Team members and their representatives. Justice advised that after launch the MODIS Working Group on L1 Integration would expand to include Level 1B update issues and would be a forum for coordinating Discipline and Science concerns.

Guenther said that MCST is 95% ready for a December 1 launch and plans to have an algorithm that works for Level 2 by L+60 days. It may not include data destriping, however. The algorithm related to viewing the moon through the spaceview port may not be ready until a year past launch. Other algorithms should be ready and running at the Science Computing Facilities (SCF's) rather than at the DAAC.

1.4 GDAAC Operations Readiness: L1 Production, Archive, Distribution, and User Services

Steve Kempler combined two scheduled presentations to report on GDAAC Readiness, regarding L1 production, archive, distribution, and MODIS user services (see Attachment 6). He began with an overview of GDAAC Mission Requirements, including both mission critical and mission essential scenarios. The GDAAC proved readiness for mission critical requirements at the recent Operational Readiness Review (ORR). The DAAC is planning to be ready for public access for Level 2 product by 6 months after launch, assuming receipt of Level 2 data at 4 months after launch. The beta Level 1 products would be ready by 120 to 150 days past launch.

Kempler said that the DAAC has the hardware units needed for launch. The DAAC has tested the performance of the system by ingesting and processing data and sending data to MODAPS. They also plan to monitor performance and the system is expected to improve and run more in the automated rather than manual mode. Reprocessing will

take place at about Launch + 1 year. Two test modes, Test Set 1 (TS1) and TS2, run in parallel with the Operations (Ops) mode at the DAAC. The GES DAAC User Services is integrating MODIS into the Terra help desk. The GDAAC also supports conferences and distributes literature and CDs. It is at full staffing with 61 people for round the clock (7 days x 24 hours per day or 7x24) staffing.

1.5 MODAPS Level 2/3 Production Readiness, Throughput Performance, Production Plan

Ed Masuoka reviewed MODAPS Level 2 and Level 3 production readiness, throughput performance, and production plans (see Attachment 7). This is the first time MODAPS is trying to use multi-granule Earth Science Data Types (ESDT's), which are used in Level 2 Oceans products that have inserted cleanly in the past. Metadata issues related to getting the updates ready have been holding up the Level 3 Land products. The beta Level 1 products should go out to the MODIS community by L+120 days. Skip Reber commented that the DAAC's could keep products on a hidden server with a hidden URL, if the MODIS team does not want them to be available to the public. An EOS Terra data product availability schedule that includes MODIS product availability can be found on the Web at:
http://grid2.gsfc.nasa.gov/~todirita/terra/terra_dataprod.html.

MODAPS and GDAAC are planning a combined production J-day (joint) test. Masuoka said that MODAPS can meet production and distribution requirements through Launch +1 year at .5x and 1x (benchmark) and it can run L2 and L3 products at 1x. The MODAPS timeframe is short and then Level 2 data is shipped to the DAAC. To order products, use standing orders, FTP push, or order from MEBDOS. MODAPS plans to meet once a week with Discipline representatives. Post-launch algorithm updating and scheduling would be developed with the Discipline representatives and algorithm upgrades could be done post launch.

1.6 MODAPS to SCF Data Distribution Capacity and Readiness

Ed Masuoka reviewed AM-1 QA SCF Sites Network Requirements versus Measured Performance and EOS AM-1 QA Sites Network Performance versus Requirement using charts prepared by Andy Germain (see Attachment 8). He said that the QA network requirements are fully ramped up, including the MODIS proposed flows. Bob Evans said that the Broadband Network Switch (BBNS) had some hardware problems. When the bad router was replaced those problems were solved for Miami. Evans said that since all of us are connected by networks outside of NASA, we need a way for NASA to bring pressure to bear on network administration. Masuoka advised contacting the operations manager of the Consolidated Space Operations Contract (CSOC) Network Operations Center and copying Sol Broder on network problems. If the network is not sufficient, the GDAAC can use 8mm tapes to ship data. It is the large flows that are problematic. Bob Evans said that if the systems run like they have during the last 6 months, then it works fine, barring anomalous periods.

Masuoka then reviewed QA data flows to MODIS SCF's: Readiness for Production (Attachment 9). He said that SDST had tested many of these data flows and asked the group to consider whether all of the flows are necessary to the SCF's at the volumes listed on the chart "External Interfaces - Q/A" (see Attachment 9). Initially, 10 percent of the flows are for QA, however, 10 percent of the volume of Science Team member's products would be sent to them for QA. Masuoka said he would e-mail a list of contacts categorized according to Level 2, Level 3, etc. to MODIS team members and that e-mail requests for subscriptions should be addressed to him.

1.7 GDAAC Operations Readiness: Level 2/3 Ingest, Archive, and Distribution

Steve Kempler discussed GDAAC Operations Readiness: L2/L3 Ingest, Archive, and Distribution (see Attachment 6). The DAAC still has some work to do in distribution to exhibit readiness for mission essential scenarios. The DAAC can not yet produce multi-tape files and there is more work to do on fault recovery. Masuoka commented that multiple files can be stored on an 8mm tape, however, if the order as a whole spans more than one tape, then it is problematic.

Kempler described three ways to access MODIS Data from the GDAAC. These are access via the EOS Data Gateway (EDG) system, anonymous File Transfer Protocol (FTP), and subscription. It may be necessary to password protect the anonymous FTP page. Sample products will be available and data will be automatically pushed to subscribers. Because of the distribution limit, some data will be distributed on tapes. Regarding L2/L3 data ingest, the multi-Earth Science Data Type (ESDT) granules have not been tested yet. The Oceans products use the multi-ESDT granules. He said Science Investigator-led Processing Systems (SIPS) interface between MODAPS and the DAAC's is working well.

The DAAC has an operational system using ECS Drop 5A.02. Kempler said they do not want to stop the system and interrupt workflow for more Mission Operation Science System (MOSS) testing now. The ECS Drop 5B (a major upgrade) is due in late April 2000 and the DAAC wants to make sure that it is thoroughly tested this time so as to not bring down operations as ECS Drop 5A did.

1.8 Early Products

Yoram Kaufman gave an impromptu talk on the schedule for early products and images. The MODIS team should be prepared to produce early images at L+60 to L+70 days. Some options include quickly running Level 2 data products or manipulating Level 1 data to generate Level 1 images that would be similar to Level 2 images. The MODIS team needs to be ready with some quick, possibly global, images from Level 1A software. Both SeaWiFS images and Landsat 7 images were released very quickly after launch. Even though Terra plans to have images available after L+60 days, Kaufman advised that the MODIS team be prepared to produce MODIS images more quickly than that.

1.9 Early Product Planning: MODIS Roles and Responsibilities

Al Fleig reviewed early product planning and MODIS roles and responsibilities. He said that SDST could make an RGB image that looks quite good. He categorized early images into three types, including images for very early distribution, images for the coordinated Terra release at Launch + 60, and images for the MODIS Web page and other Web pages (LDOPE, Miami, etc.). Fleig discussed developing a standard for MODIS images and options for including MODIS and/or EOS logos, credits, and references. Credits could include the names of Science Team members, the product developer, the Discipline group, and references to the developers/scientists of predecessor products. He suggested that sample images exemplify the uniqueness of MODIS capabilities. Fleig said that images could be posted on the MODIS Web Page, if sent via FTP with accompanying text and the Science Team member's name. Salomonson stated that the Discipline Leads should decide on how to identify and review images. Kaufman commented that we could coordinate with Jim Collatz and the quick response team for images that are accessible to the general public. He also suggested comparing MODIS images to older images (from AVHRR, etc.).

1.10 EOS-Aqua Instrument Status

Neil Therrien reported on FM1 status (Attachment 10). Thermal vacuum 3 (TV3) was completed in August 1999 and the initial objectives were accomplished. The instrument is scheduled to ship to TRW on November 17, 1999. Therrien detailed issues that surfaced during TV3. These included correlated noise by about 50 DN's, a one-time registration shift, ADC bin size anomalies, and gain change of Bands 23 and 32. FM1 SMWIR Band 5 and Band 6 operability issues were discovered after TV3 with 11 non-responsive channels on Band 6 and one non-responsive channel on Band 5. SBRS plans to continue the analyses of these issues and to monitor these anomalies.

2.0 Second Day Plenary Session: Overview

Vince Salomonson welcomed the group and reviewed the second day agenda. Three additions to the agenda for the day included Michael Hohner's presentation on the MODIS Document Archive (MODARCH), Chris Justice's presentation on MODIS-related Web sites, and Gene Legg's presentation on MODIS and NOAA.

2.1 EDC Readiness: Transfer and Ingest from MODAPS, Distribution of MODIS Data, User Services

John Dwyer reviewed EDC DAAC Terra Readiness (see Attachment 11). EDC is operating the ECS system in TS1, TS2 and Ops modes and began implementing ECS Drop 5A.02 last night (November 16, 1999). They still plan to run some operational readiness exercises. EDC would begin receiving data from MODAPS at L+60 and based on a December 3, 1999 Terra launch, they would release data to the public on April 2, 2000. They are also planning on receiving some early data at L+35. Dwyer said that

EDC would like to discuss enhancing network transfer (by using CD-ROM and DLT production capability) with their customer user base and the science panel.

User support for MODIS at EDC goes through customer service representatives (CSR), DAAC user services/ESDS, the MODIS Science Representative, Calli Jenkerson, and then to the MODIS Science Coordinator (MSC), Robert Wolfe. Now that EDC has been in operations mode for 3 to 4 months for Landsat 7, they have reviewed how that is working and they are developing a database of frequently asked questions (FAQ's). They provide a tutorial for users on the EOS data gateway (EDG). The CSR's receive up to about 50 calls per day and the system has to work easily. The customer service staff uses the same tool as EDG to place orders. EDC has a dedicated e-mail address (edc@eos.nasa.gov) and Web page for user services (http://edc.usgs.gov/landdaac).

EDC is developing sample data products so that the instrument team and science community would not be affected by frivolous data requests. Justice suggested that EDC not let Landsat 7 selection drive the MODIS sample data products and that the focus for the sample data products could be through validation sites. Dwyer said EDC has an alternative method for search query order for Landsat 7and that depending on the response to that, they may use a non-ECS search and order system for Landsat. They plan to work with the MODIS Land group on developing the labeling for MODIS images.

2.2 NSIDC Readiness: Transfer and Ingest from MODAPS, Distribution of MODIS Data, User Services

Greg Scharfen reported on NSIDC readiness, summarized the MOSS-3 testing, and presented highlights of the ORR (see Attachment 12). He said NSIDC is on track for MODIS operations and plans to ingest snow and ice products by L+60 and be ready to do so earlier than that. Testing is on schedule, but was affected by some metadata errors, low data volume, and slowed down MODAPS production. NSIDC received between 25 to 75 percent of what was sent to them from MODAPS. Problems were due to ESDT and metadata errors that currently are being fixed. NSIDC is already in ECS Drop 5A.03 Ops mode. They are running continuous but less formal testing that includes the MOSS-5 with some EDG tests. A formal shutdown will occur over the Thanksgiving weekend. NSIDC has signed an Operations Agreement (OA) with MODAPS. It is a 5x9 (5 days and 9 hours per day) DAAC that is smaller than the GDAAC, a 7x24 operation. Two of the 5-person user services staff serve on MODIS user services and they have a science staff. The MODIS product team meets biweekly and an operations group meets weekly. NSIDC has developed a Web page that can be accessed through the MODIS Web page.

2.3 The MODIS Web Site

Michael Hohner presented an overview on the MODIS Web site and recent updates and plans for it. The MODIS Document Archive (MODARCH) currently contains about 8000 records linked to PDF and HTML files, including meeting minutes and

attachments, publications, and a historical archive of ATBD's. There are over 1000 Web pages on the MODIS site. The username and password for MODARCH was changed on August 20th, 1999. To request access to MODARCH, please contact Hohner at: mhohner@pop900.gsfc.nasa.gov.

Hohner said there were several updates to the MODIS Web site recently and more are planned. He has redesigned the MODIS Discipline Group pages and linked the Atmosphere page to the Atmosphere Group's new Web site (see http://ltpwww.gsfc.nasa.gov/MODIS-Atmosphere/) which has detailed descriptions of their Level 2 and Level 3 data products. The MODIS Land and Ocean Discipline Groups are developing similar sites to provide detailed descriptions of their higher level data products. As these sites become available, links will be added to the MODIS Web pages. Hohner is also coordinating MODIS Web development with the DAAC's to reduce duplication of content and ensure required content is generated by one responsible party.

Eleven "light" or non-technical data product descriptions have been added to the MODIS Web site. These are popular and are requested about two to three times as often as the full science data product descriptions. The Science Team Publications section, which contains a list of works (journal articles, conference articles, and monographs) authored by MST PI's and Associates has been redesigned. The publications Web page has grown significantly in the last year to more than 200Kb, with 633 citations (including links to 428 abstracts, and 281 full-text articles). The main page has been redesigned to support other methods of browsing (see http://modarch.gsfc.nasa.gov/MODIS/PUBS/index.html). A new Citation Search Interface has been added to enable simple and advanced searches of the publications database. Publications pages still are produced for each MODIS Science Team member and should be consulted by PI's to confirm that content is accurate. Hohner also has added a search interface to the directory of MODIS-related personnel (see http://modarch.gsfc.nasa.gov/cgi-bin/texis/MODIS/VTX/directory). The directory contains more than 110 names. Contact Barbara Conboy or Michael Hohner to update any directory information or add new listings.

Individual or group training is available for any of the search interfaces on the MODIS Web site. Hohner invited the MODIS Team to check out the search interfaces and send him their feedback.

Future changes to the MODIS site include new/updated images to provide a uniform look to the pages, reformatting to provide logical organization of information and provide a portal to other MODIS sites, and moving from a frames version to a non-frames version of the site. This will make it easier for other sites, such as the DAAC, to link to MODIS.

In response to questions by Science Team members about the necessity for password protection on the MODIS Web site, Hohner took an action to reassess the use of the

password protection on MODARCH and to examine using password protection only for the proprietary documents.

2.4 Coordination of MODIS-Related Web sites

Chris Justice presented a preliminary draft of a map of MODIS-related Web sites (see Attachment 13) and encouraged the group to coordinate their MODIS Web site efforts. MODIS-related Web sites include MODIS news, early images, meetings, and links to the MCST Level 1B sites, Land product status, SCF's, Atmosphere products, Oceans sites, the DAAC's and other MODIS-related sites. Wayne Esaias suggested that it would be useful to develop a guide to the MODIS-related sites and advertise this structure/map on the MODIS Web site. He also asked whether NOAA has a MODIS Web page.

2.5 NOAA

Gene Legg reported on the National Oceanic and Atmospheric Administration (NOAA) MODIS progress. His brief talk was an impromptu addition to the agenda. The NOAA system is a copy of the MODIS Adaptive Processing System (MODAPS). However, NOAA has limited the scope of their products to the United State mainland. They are keenly interested in MODIS Oceans, Atmosphere, and Land products.

NOAA has conducted some discussions on first images and has an internal advisory panel that approves product release. They have agreed to have MODIS representatives serve on the NESDIS data product review boards that are called Product Oversight Panels (POP's). NASA MODIS representatives will be integrated into the NOAA review process and report on status to the MODIS Technical Team.

Legg said that NOAA plans to turn around products in approximately 3 hours, within about 9 or 10 months after launch (following the NCEP models). Salomonson commented that MODIS data would be sent via bent pipe to NOAA and to direct broadcast receiving stations at Goddard Space Flight Center (GSFC) and in Hawaii, Miami, and Wisconsin.

2.6 Terra Launch Status

Kevin Grady presented an overview that traced the Spacecraft Status and progress of recent preparations for the upcoming Terra launch (see Attachment 14). Highlights included lifting the approximately 10,700 pound spacecraft and positioning it on the launch vehicle interface adapter. The pre-ship review included oversight by a Code 300 review team, a senior review Group, an external Independent Readiness Review, and Lockheed mission success reviews. Four formal End-to-End (E-T-E) tests were conducted between the spacecraft and the EOC, with one at Valley Forge and three at Vandenberg Air Force Base. Rehearsals and simulations were conducted and the spacecraft was fueled on October 27, 1999. The spacecraft is potentially scheduled to be taken to the launch pad on November 29, 1999. Once on-orbit, an approximately 90-day checkout period is planned. At about Day 60, a Science Working Group for the AM

Platform (SWAMP) will be convened to assess instrument checkouts and determine if a deep space maneuver would be scheduled for Day 71. Grady said that January 10 or 26, 2000, would be the next possible launch dates if Terra does not launch on December 16 or 17, 1999.

2.7 SeaWiFS

Chuck McClain presented a SeaWiFS Update with Terrestrial and Atmospheric Applications (see Attachment 15). He said SeaWiFS has been producing NVDI products and has future plans for other similar products. Using Global Area Coverage (GAC) and Local Area Coverage (LAC), the SeaWiFS project schedules coverage over validation sites and can also schedule over ships of opportunity. To date they have supported more than 132 cruises over 2 years. They get solar calibrations once per day and lunar calibrations once per month. Every 2 days they get complete global coverage. They have received data from 71 stations in the High Resolution Ground Station Network (HRPT). Upon receiving data, they do quality control and then the data passes on to the DAAC. At least 20 to 30 stations are very reliable. One of the requirements on the ground stations for NASA authorized stations is that they must hold data for about a month and then can only release it to NASA authorized users. The digital data is restricted for 14 days and browse quality data is available through the SeaWiFS Web site. McClain said the DAAC has done a great job of distributing SeaWiFS data. Reprocessing is done in parallel with routine processing. The SeaWiFS project processes data as it comes in and nothing gets released to the DAAC until it is approved.

The SeaWiFS project, MODIS Oceans Discipline team, and SIMBIOS project collaborate and the three projects are complementary. Four cruises that are scheduled next year to provide validation for MODIS are co-funded by EOS validation and the MODIS Oceans team serves as the SeaWiFS instrument team. The SeaWiFS project is planning to add some new products and will initiate evaluation products in parallel with archive products. After the next reprocessing, they may use the absorbing aerosol index to have a dust flag. McClain said they are looking to expand their product suite and looking for partnerships.

2.8 MODIS Discipline Group Meetings

The MODIS Atmosphere, Land and Oceans Discipline Groups held breakout meetings after the MST plenary sessions. Summary minutes from the MODLAND and Oceans Groups are included as Attachments 16 and 17.

2.9 Closing Remarks

Vince Salomonson advised the MODIS Science Team to continue to plan for early images and how to label them. He asked for suggestions on when to hold the next MODIS Science Team meeting and recommended having an early results symposium at

about 9 months after launch. Salomonson took an action item to update the Science Team on the Terra launch date status.